Montana State Legislature

2011 Session

Exhibit 4

This exhibit is a booklet which can not be scanned, therefore only the front cover/table of content and 10 pages have been scanned to aid in your research.

The original exhibits are on file at the Montana Historical Society and may be viewed there.

Montana Historical Society Archives
225 N. Roberts
Helena MT 59620-1201

EXHIBIT 4
DATE 2/14/11
HB 433

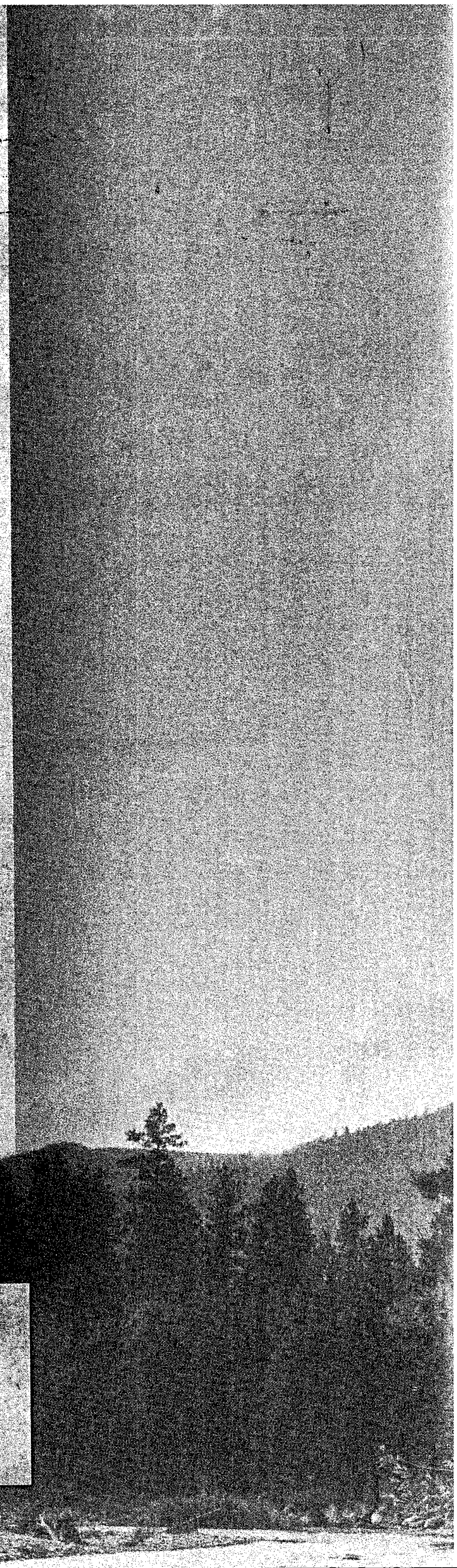
Evaluation o
Montana's Water Re

Using a Water Budget Approach

Montana

Association of REALTORS®

Table of Contents



This report examines the water resources situation in selected closed basins in Montana using basic hydrologic principles that are predicated on a scientific methodology known as the Water Budget.

Introduction

The status of water resources in the United States varies dramatically for a variety of reasons that are predicated largely on climate, geology, and population. The availability of water is a major factor affecting the density and distribution of population, which, in turn, impacts the nature of economic growth over a variety of sectors including agriculture, power, industrial, commercial, housing, and recreation.

Montana has been highly dependent upon on its water resources for more than one and one-half centuries. This resource was instrumental in serving Montana's initial economy, which thrived on resource extraction and agriculture. As Montana's economy has evolved, its use of water has been expanded to include recreation, power, commercial, and housing growth. In effect, these new opportunities have made for a more prosperous Montana.

We as Montanans have a relatively abundant supply of surface water and groundwater. From a volume perspective, most water use in Montana is appropriated from surface water. More recently, there has been an increasing demand for groundwater for a variety of purposes including agriculture, municipal, and private water supplies. Although the amount of groundwater use is presently very small in comparison with available volume, some are concerned that a growing demand on groundwater supply may cause adverse impacts to others who depend upon surface water.

MONTANA'S CONSTITUTION AND WATER USE ACT both contemplate that water is and should be available for the use and development of the people of Montana. Specifically, it is express state policy that "All surface, underground, flood, and atmospheric waters within the boundaries of the state are the property of the state for the use of its people and are subject to appropriation for beneficial uses as provided by law." Mont. Const. Art. IX, Sec. 3(3); see also, Mont. Code Ann. §85-2-101(1). Furthermore, in Mont. Code Ann. §85-1-101, the Montana Legislature has declared the following policies regarding water use:

(1) The general welfare of the people of Montana, in view of the state's population growth and expanding economy, requires that water resources of the state be put to optimum beneficial use and not wasted.

(2) The public policy of the state is to promote the conservation, development, and beneficial use of the state's water resources to secure maximum economic and social prosperity for its citizens.

(3) The state, in the exercise of its sovereign power, acting through the department of natural resources and conservation, shall coordinate the development and use of the water resources of the state so as to effect full utilization, conservation, and protection of its water resources.

In order to facilitate such use, the Montana Water Use Act contemplates that Montanans will have a procedure to obtain new appropriation rights in the wider context of the prior appropriation system.

Water Rights

Montana is a prior appropriation state as are most of the western states. Under the prior appropriation doctrine, one's priority, or ability to appropriate water during low flow periods, is based on the date that the water user first appropriated water and applied that water to beneficial use. One of the key phrases of the prior appropriation doctrine is "first in time, first in right." The prior appropriation doctrine protects senior water users by granting them the ability to "make call" on junior users, meaning that during periods of lower flows, water users with earlier priority dates can require water users with later priority dates to cease use, thereby insuring that water is available for more senior users.

As applied in the Montana Water Use Act, Mont. Code Ann. §85-2-101, et. seq., the prior appropriation doctrine prohibits any later appropriation from adversely impacting senior water users such that senior water users cannot reasonably exercise their water rights. However, prior appropriation does not grant senior water users the right to prevent any changes in water conditions. See, Mont. Code Ann. §85-2-401(1). Moreover, the Montana Water Use Act provides an exemption to the beneficial use permit process for small domestic and stock water wells that pump less than 35 gallons per minute and utilize less than 10 acre feet of water annually. See, Mont. Code Ann. §85-2-306(3)(a).

REALTOR® Legislative Position Statement on Water

The 2008 MAR Political Affairs Committee and MAR staff examine a multitude of issues that concern the industry and property owners and make policy recommendations to the MAR Board of Directors. MAR has adopted the following position statements relating to water:

Water Rights

REALTORS® believe it is important for the State of Montana to complete the water rights adjudication process in a timely manner in order to protect existing water rights and assure water availability for future needs, including domestic use. Failure to complete adjudication makes Montana vulnerable to downstream states who take water for their needs while impacting recreational opportunities and other water-related activities in Montana. When adjudication is complicated by the water compacting process, we strongly support allowing the State Reserve Water Rights Compact Commission to enter into an Interim Agreement with the parties involved. We support the present system of appropriation of water rights through state water law.

REALTORS® also believe that while the proper review of new appropriations of water and changes in existing appropriations is necessary to protect existing senior users, such review should not be used in such a manner as to maintain zero change in stream conditions or as a method of regulating land use and development. REALTORS® fully support the constitutional right of all Montanans to appropriate waters of the state for beneficial uses as provided by law.

Closed Basins

Closed basins are watersheds in Montana that have been closed to further surface water appropriations pending the adjudication of existing surface water claims. An excellent overview of closed basins is provided by the Montana Bureau of Mines and Geology ("MBMG") (LaFave, 2008). Statutory basin closures were enacted to close selected basins to new surface water appropriations until adjudication could be completed. In short, the closed basin statutes were meant to impose a moratorium on surface water claims until the Montana Water Court could sort out the existing surface water claims. However, in enacting the closed basin statutes, the legislature also made provisions for specific exemptions to allow limited continued new appropriations, even while adjudication was pending. These specific exemptions include exemptions for new groundwater development.

REALTORS® support the development and implementation of clear and consistent rules for the permitting of new appropriations of water and changes in existing appropriations, applied equally to applicants and objectors. The laws of Montana have established independent systems for the regulation of water quality and water rights, and REALTORS® believe that such a system should be maintained.

Water Quality

REALTORS® understand that clean water is a key element of a healthy environment. Montana's water nondegradation law is one of the toughest in the nation. We support the Montana Water Quality Act and continued state primacy in establishing standards and criteria aimed at protecting our health and safety as long as they are based on scientific evidence.

Exempt Wells

REALTORS® believe that exempt wells must be preserved. The use of exempt wells to provide water for residential purposes is, in part, a response to the difficulties and costs associated with the process of applying for new beneficial use permits and transferring existing water rights. REALTORS® support establishing a more efficient water rights permitting process and implementation of that process in a clear and consistent matter.

More recently, concerns have surfaced regarding groundwater-surface water interaction in closed basins and whether new groundwater appropriations in closed basins will adversely affect surface water appropriators. That concern has led, in turn, to the enactment of House Bill 831 by the 2007 Legislature. The main purpose of this bill was to require some form of mitigation in the event that a proposed groundwater appropriation would adversely impact surface water users.

Surface Water and Groundwater Interaction

Scientists have recognized for well over a half a century that surface water and groundwater systems are connected or integrated. In other words, use of one may affect the other. For instance, pumping groundwater may intercept groundwater that would otherwise have eventually entered streams. Similarly, changes in the way that surface water is used can also affect the rate and distribution of recharge to groundwater systems. For example, surface water diversions for agricultural use can reduce recharge that may occur from a stream, b at the same time, increase recharge at other loca from ditch seepage and land application of irrigat water.

Population Growth and Water Deman

It is important to understand the relative magnit of water demand that occurs from population gr In some instances, irrigated land has been replace with residential development as cities grow and subdivisions develop over time. The net significan of this can be twofold. On one side of the coin, t will be increased water requirements to support this growth. Yet, on the other side, land that had been irrigated for agricultural purpo theretofore is no longer being irrig decreasing net water demands. Another possibility is that growth occur over lands that had not bee historically irrigated. All these cre a level of complexity in determin just how the hydrologic system respond to these changing land use practices and changing wate demands.

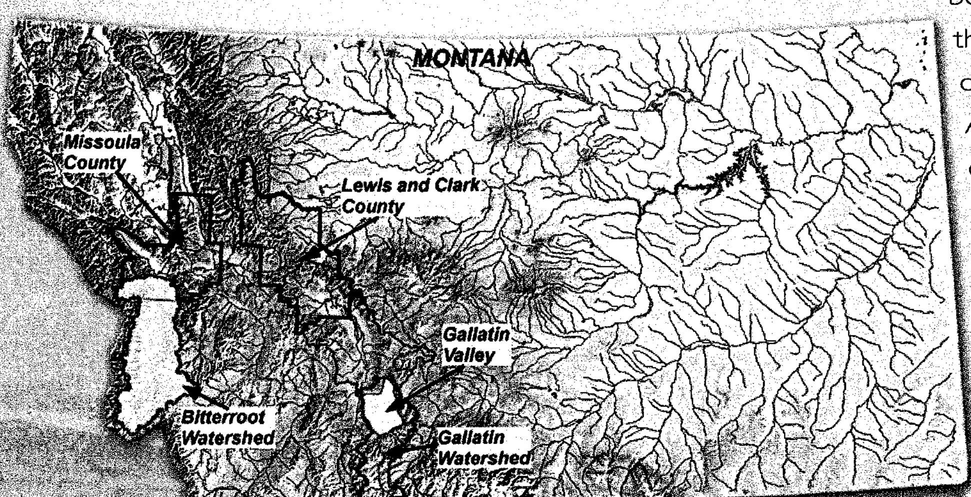


Figure 1 *Project Study areas (NE&W, 2008)*

Some believe that Montana is presently suffering the same fate as other western states such a Colorado, Arizona, Texas, and New Mexico, which are all grappling with groundwater developmen and shortages. However, it is important to recognize that conditions from state to state vary drastically. For instance, the status of hydrologic, hydrogeologic, and other factors, including economics and population, is not the same in Montana as they are in Colorado, Arizona, Texas, or New Mexico. Groundwate demands in Montana are much lower when compared to other states (Hutson et al., 2000):

• Montana	**188 million gallons per day (mgd)**	
• Colorado	**2,320 mgd**	**12 times the Montana demand**
• Arizona	**3,420 mgd**	**18 times the Montana demand**
• New Mexico	**1,540 mgd**	**8 times the Montana demand**

Additionally, water supplies are much different in these states as a result of precipitation over a larger land area. The total amount of annual precipitation is greater in Montana when compared to the other states. For example, according to the US Geological Survey, Montana's total precipitation is 17% more than Colorado an 30% more than New Mexico (Carr et al., 2000).

When it comes to population growth and water demands, several questions remain to be answered:

- How much has net water use changed with development?
- Has there been a net increase or decrease in water use?
- Has the development been significant enough that the impacts are evident in changing streamflows or changing groundwater levels?

These and many other questions need answers that are derived from evaluations employing basic scientific principles.

Groundwater Levels

Work by the MBMG shows that groundwater level changes are dominated by climatic factors (Patton, 2007). MBMG has not determined that declines associated with groundwater development are significant in Montana. In effect, unlike what has occurred in the Ogallala aquifer in Western Texas, there is no evidence of changes in aquifer storage over time associated with groundwater development in Montana.

In order to determine cause-and-effect changes in streamflow and groundwater levels, it is necessary to examine all underlying factors. For instance, what is the impact of climate and all uses of water from agriculture, power generation, housing, etc. This report examines the water resources situation in selected closed basins in Montana using basic hydrologic principles that are predicated on a scientific methodology known as the water budget. The areas examined are shown in Figure 1 on the previous page.

Hydrologic Cycle

Groundwater and surface water are components of a complex, dynamic system that is known as the hydrologic cycle, which is illustrated in Figure 2. Nearly all precipitation ultimately seeps into the ground, flows overland and in streams, and evaporates or is transpired into the atmosphere from plants. There are several human interventions that affect both surface water and groundwater, including dams that control streamflow, diversions of water for agricultural irrigation, and diversions for municipal or domestic use.

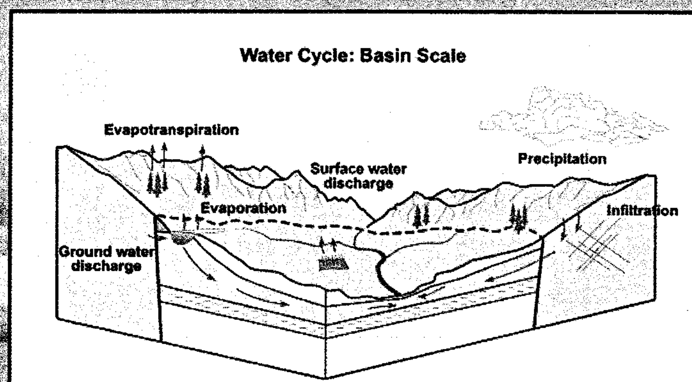


Figure 2 *Schematic representation of the hydrologic cycle in a typical Montana basin scale. Adapted from Montana Bureau of Mines & Geology (2008).*

Montana's climate is cooler and, except for Colorado, has higher annual average precipitation than the other states. Montana is a headwater state with significant mountainous regions where winter snowfall accumulates and then supplies streams and rivers. This same surface water recharges the valley aquifers. The volume of water leaving Montana as streamflow is significantly higher than other states (Carr et al., 1987).

• Montana	39,500 mgd	
• Colorado	11,600 mgd	29% of Montana's surface water outflow
• Arizona	12,700 mgd	32% of Montana's surface water outflow
• New Mexico	3,000 mgd	8% of Montana's surface water outflow

In simple terms, Montana has a large water supply, with much lower demand and exports much more water than these other states. ***In effect, Montana has more water and uses less of it when compared to these states.*** When all the relevant comparisons are made to other states, Montana's groundwater is an untapped resource.

Some parts of the country have shown significant declines in groundwater levels. For instance, the Ogallala aquifer in Western Texas has shown significant declines in groundwater levels. Most of these declines are associated with center pivot irrigation from agricultural irrigation. This has resulted in a storage decline of about 50 million AF from 1990 to 2004.

Water Budgets

One basic methodology used in quantifying water availability and water use is known as the water budget. According to the U.S. Geological Survey (Healy et al., 2007):

> Water budgets provide a means for evaluating availability and sustainability of a water supply. A water budget simply states that the rate of change in water stored in an area, such as a watershed, is balanced by the rate at which water flows into and out of the area. An understanding of water budgets and underlying hydrologic processes provides a foundation for effective water-resource and environmental planning and management. Observed changes in water budgets of an area over time can be used to assess the effects of climate variability and human activities on water resources. Comparison of water budgets from different areas allows the effects of factors such as geology, soils, vegetation, and land use on the hydrologic cycle to be quantified.
>
> Human activities affect the natural hydrologic cycle in many ways. Modifications of the land to accommodate agriculture, such as installation of drainage and irrigation systems, alter infiltration, runoff, evaporation, and plant transpiration rates. Buildings, roads, and parking lots in urban areas tend to increase runoff and decrease infiltration. Dams reduce flooding in many areas. Water budgets provide a basis for assessing how a natural or human-induced change in one part of the hydrologic cycle may affect other aspects of the cycle.

In summary, water budgets are valuable for understanding the relative significance of water use transitions and other factors that may affect both surface water and groundwater supplies in Montana. A water budget is an accounting of water inputs, outputs, and storage over a fixed area or volume conducted over time. Depending upon the water budget boundaries, inputs can include precipitation and streamflow. Outputs can include streamflows, evaporation and transpiration, well pumping, and reservoir evaporation. Storage changes can result when reservoir water levels decline. Groundwater storage can change if water levels increase or decrease. In essence, a water budget is akin to a banking account where one tracks bank deposits, withdrawals, and the account balance over time.

The water budget equation is simple, *universal,* and adaptable because it relies on a few assumptions on the fundamentals of water movement and storage. A basic water budget for a watershed can be expressed as follows (Healy et al., 2007):

$$P + Q_{in} = ET + \Delta S + Q_{out}$$

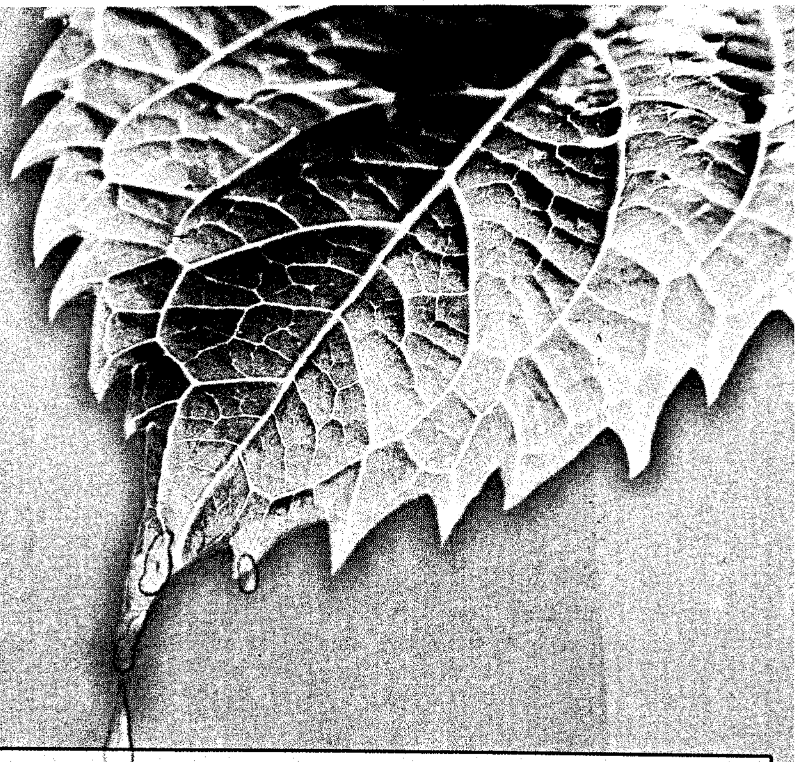
where

P	is precipitation;
Q_{in}	is water flow into the watershed;
ET	is evapotranspiration (the sum of evaporation from soils, surface water bodies, and plants);
ΔS	is change in water storage; and
Q_{out}	is water flow out of the watershed.

The water budget can be applied to various scales. For example, it can be statewide or it can be at a local scale, such as the Gallatin Valley or the Bitterroot Valley. Sometimes specific data are not available, and inputs or outputs must be estimated as closely as is practical. Understanding each component is necessary in order to reliably quantify the degree of human-induced influence on the water budget.

...water budgets are valuable for understanding relative significance of water use transitions and other factors that may affect both surface water and groundwater supplies in Montana.

An average of 43.8 million AF (about 328 billion gallons) of water flows out of Montana each year via the Yellowstone, Missouri, Clark Fork, and Kootenai Rivers.



What Is Montana's Overall Water Budget?

A general water budget assessment for Montana was developed by the USGS (Cannon and Johnson, 2004). Montana receives an average of about 118.4 million acre feet (AF) of water in the form of precipitation each year (about 886 billion gallons). An AF is a volume measurement commonly used by agricultural irrigators. One AF is the same as one foot of water spread evenly over one acre of land, or equal to 325,800 gallons of water.

An average of 43.8 million AF (about 328 billion gallons) of water flows out of Montana each year via the Yellowstone, Missouri, Clark Fork, and Kootenai Rivers. The difference between the incoming 118.4 million AF and the out-flowing 43.8 million AF is 74.6 million AF. This difference is the water that is transferred directly to the atmospheric portion of the hydrologic cycle via evaporation and plant transpiration. Much of the plant transpiration is associated with native vegetation.

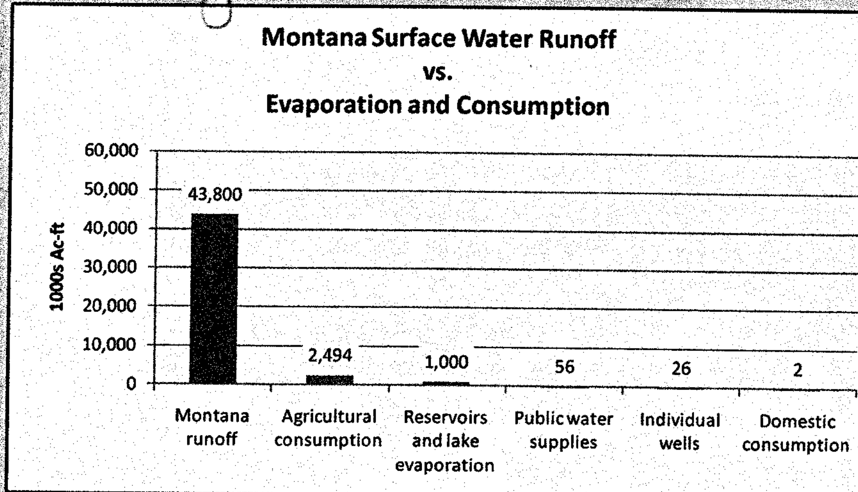


Figure 3 *Montana Surface Water Runoff compared to various annual consumption rates (note that this is for comparison purposes; some categories may overlap).*

Some Basic Terminology

Evapotranspiration: Evapotranspiration simply represents the water returned to the atmosphere via a combination of evaporation and transpiration by plant growth (see water budget equation on the previous page).

Aquifer: An aquifer is considered a hydrogeologic unit that is capable of transporting groundwater at rates sufficient to yield economically significant quantities of water to wells and springs.

Recharge: Recharge involves all the processes that add water to a saturated zone.

Phreatophyte: A phreatophyte is a deep-rooted plant that obtains water from the underlying groundwater. These plants often use large volumes of water. Two examples that are relevant to Montana are cottonwoods and willows.

Consumptive Use: Consumptive use represents the amount of withdrawn water lost to the immediate hydrologic environment through evaporation, plant transpiration, incorporation into products or crops, or consumption by humans and livestock.

According to the USGS, the total amount of water withdrawn in Montana from surface water and groundwater combined is about 12 million AF (90 billion gallons). However, a majority of the withdrawal is "recycled" as flow returning to groundwater as recharge, which eventually enters streams.

Let us consider surface water first. Again, about 118.4 million AF (about 328 billion gallons) of precipitation falls on Montana each year. Of this, about 2.7 million AF (20 billion gallons) is consumptively used by human actions. Thus, about 2.3 percent of the precipitation that falls on Montana each year is consumed.

Again, the amount of water flowing out of Montana is 43.8 million AF each year. Figure 3, on the previous page, compares the consumptive uses to the flow leaving Montana each year. These uses can be compared to some of the following categories (Cannon and Johnson, 2004):

- Agricultural consumption from crops and livestock: 2.49 million AF;
- Reservoir and lake evaporation: 1 million AF;
- Public water supplies: 0.056 million AF;
- Individual wells: 0.026 million AF; and
- Household use such as washing, drinking, etc.: 0.002 million AF.

Using these statistics, the total consumptive use from individual wells is 0.05 percent of the overall combined consumptive use from agriculture and reservoirs/lakes. Using another comparison, the total annual consumptive use from individual wells is about 0.005 percent of all surface water leaving the state of Montana each year.

If we combine all uses for municipalities, subdivisions, and individual wells in Montana, they equate to about 0.2 percent of the streamflow leaving Montana each year. Even when we combine these uses they are too small to be measurable in the streamflows of Montana.

What Is the Projected Impact of Population Growth?

Using the results shown in Figure 3 on the previous page, the actual consumption for housing and municipalities is about 0.2 percent of all the outflow of water leaving Montana each year. Population growth will require additional water supply. However, in order to put the projected increase in perspective, it is practical to use the U.S. Census Bureau's projection that Montana's population will grow another 16 percent by 2030. Using a simple ratio, it can be projected that the net relative increase in water consumption from this growth will be approximately 0.03 percent by 2030. Hence, the net overall demand strictly associated with water supply needs of municipalities, public water supplies, and individual homeowners would be about 0.23 percent of all the total water consumption in Montana in 2030. This calculation does not consider decreased consumption in other areas as irrigated agricultural property is converted into residential development.

If we combine all uses for municipalities, subdivisions and individual wells in Montana, these equate to about 0.2 percent of the streamflow leaving Montana each year.

Local Scale Water Rights

What About Water Budgets at the Local Scale?

Nicklin Earth & Water ("NE&W") conducted water budget evaluations for four different areas of Montana (NE&W 2007 and NE&W 2008a). The primary purpose of evaluating these different areas was to determine if observations were consistent among high growth areas. The high growth areas examined were the Gallatin Valley, Bitterroot Valley, Lewis and Clark County and Missoula County. All of these areas show increases in groundwater development from population growth. In all of these instances, the water budgeting approach described by the USGS was employed.

The primary results of the analysis are that the local-scale results are simply a microcosm of the statewide observations. In effect, overall water use by housing and municipalities is currently very small and is projected to remain very small through at least 2030.

Gallatin Valley Water Resources

The Gallatin Valley is located at the northern end of the Gallatin watershed (see Figure 4). This valley is the center of a thriving and diversified county that has been historically agriculturally based. More recently, economic activity in the valley has become more diversified and includes agriculture, rapid commercial and residential development, an expanding state university, and a growing high-tech sector. Along with growth in these core economic sectors, the service industry also has greatly expanded. Gallatin County has seen more rapid population growth than almost any other county in Montana. Hence, concerns have developed regarding the impact of groundwater development upon available streamflows in the valley. The concerns are exacerbated by the fact that the entire Gallatin watershed is subject to the Upper Missouri River Basin Closure.

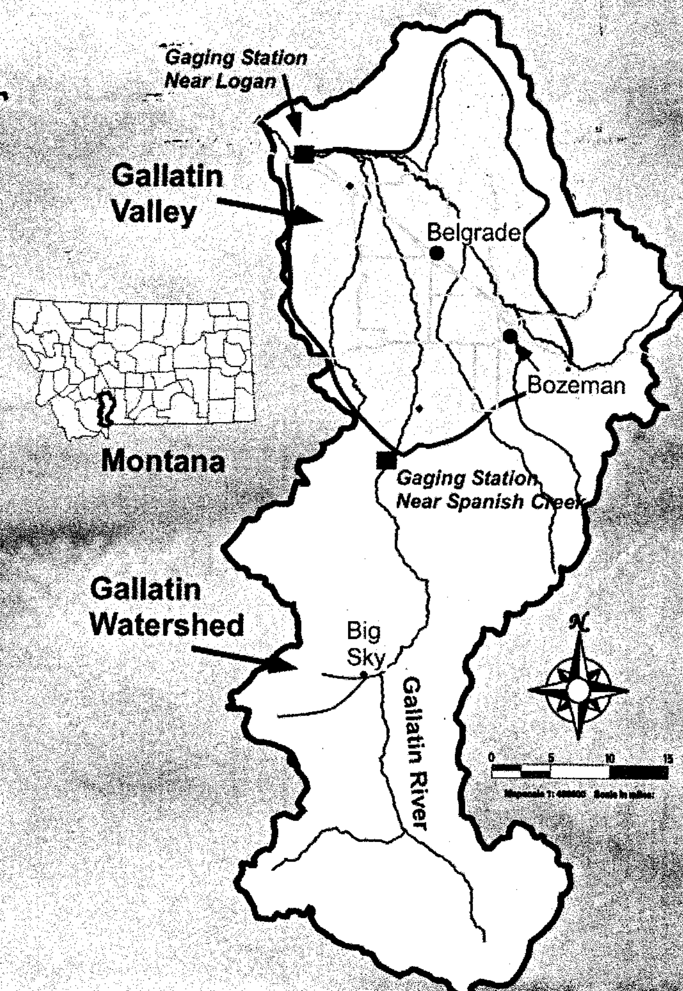


Figure 4 *Gallatin Watershed and Gallatin Valley.*

Overall water use by housing and municipalities is currently very small and is projected to remain very small through at least 2030.